MATH CAMP SYLLABUS

Summer 2016

Class Information
Course: Math Camp
Time: August 8-12
Location: Wylie Hall 101

Instructor Contact
Instructor: Xin Wei
Office: Wylie Hall 310
E-mail: wei24@indiana.edu

GENERAL INFORMATION

Course Description

This refresher course is designed to help incoming graduate students brush up on analysis, calculus and linear algebra required for success in the program, especially in the first year. The course makes a tight connection between the general mathematical knowledge in undergraduate courses and their applications in graduate courses.

This course is in close coordination with the E520 course. Practice is emphasized and a lot of time will be devoted to problem solving. There will be four problem sets to help you grasp the related materials.

Prerequisites

Students are expected to have taken three-course sequence in calculus, including multivariate calculus, and one course in linear algebra. Experience in real analysis is a plus.

Required Textbook

The instructor will use his own notes. For students who need a more detailed reference, this book is of the most relevance:

Simon, C.P. and Blume, L. (1994). *Mathematics for Economists*.

LAYOUT AND CONTENTS

Math camp will meet from 10:00-10:50, 11:00-11:50, and 1:30-3:00pm from Monday August 8 to Friday August 12. The morning sessions will be lecture format. The afternoon session will work problem sets and introduce students to Matlab. You'll cover basic analysis/topology, calculus of one variable, linear algebra and calculus of several variables. For the afternoon session, you should bring your own laptop. Matlab is available via the service

of IUanyWare. Make sure you could log in IUanyWare with your IU Network ID before coming to class on August 8. A detailed list of topics goes as follows:

1. Basic Analysis/Topology
    - Euclidean spaces
    - metric spaces and some basic topology
    - numerical sequences: convergent sequences, Cauchy sequences, upper/lower limits
    - series
    - continuity: limits of functions, continuous functioncs, continuity and compactness
    - the intermediate value theorem
2. Differentiation
    - the derivative of a real function
    - mean value theorems
    - L'Hospital's rule
    - Taylor's theorem
3. Integration
    - definition and existence of the Riemann integral
    - properties of the Riemann integral
    - the fundamental theorem of calculus
4. Linear Algebra
    - vector spaces and subspaces
    - linear combinations and systems of linear equations
    - linear independence, basis and dimension
    - linear transformations and their matrix representations
    - the rank of a matrix and matrix inverses
    - determinants and Cramer's rules
    - quadratic forms and definite matrices
5. Multivariate Differentiation
    - total differentiation and the chain rule
    - partial differentiation, Jacobian and gradient
    - continuous differentiability

- the inverse function theorem

6. Prerequisites for Convex Analysis
   - concave functions, convex functions and definiteness
   - quasi-concave and quasi-convex functions
7. More Topics
   - eigenvalues and eigenvectors
   - difference equations
   - the implicit function theorem
8. An Introduction to Matlab
   - Matlab basics
   - vectors and matrices in Matlab
   - solving linear systems
   - solving optimization problems

SUPPLEMENTAL READING LIST

Some students may also find the following readings helpful:

- Novshek, W. (1993). *Mathematics for Economists.*
- Rudin, W. (1976). *Principles of Mathematical Analysis (3ed).*
- Rudin, W. (1987). *Real and Complex Analysis (3ed).*
- Rudin, W. (1991). *Functional Analysis (2ed).*
- Friedberg, S.H., A.J. Insel and L.E. Spence (2002). *Linear Algebra (4ed).*
- Billingsley, P. (1995). *Probability and Measure (3ed).*
- Armstrong, M.A. (1983). *Basic Topology.*
- Dixit, A.K. (1990). *Optimization in Economic Theory (2ed).*
- Mas-Colell, A., M.D. Whinston and J.R. Green (1995). *Microeconomic Theory.*
- Ljungqvist L. and T.J. Sargent (2012). *Recursive Macroeconomic Theory (3ed).*

- Stokey N.L., R.E. Lucas Jr. and E.C. Prescott (1989). *Recursive Methods in Economic Dynamics*.

- Acemoglu D. (2008). *Introduction to Modern Economic Growth*.

- Hamilton, J. (1994). *Time Series Analysis*

- Mathworks. *Getting Started with MATLAB*. `http://www.mathworks.com/help/matlab/index.html`